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High School and University Student Test Performance in the Study of Human Growth and Development: A Concurrent Enrollment Study

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HIGH SCHOOL AND UNIVERSITY STUDENT TEST PERFORMANCE IN THE STUDY OF HUMAN GROWTH AND DEVELOPMENT: A CONCURRENT ENROLLMENT STUDY

by

Harold O. Monson

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Concurrent enrollment of high school students in college classes is becoming more common but it has not been clear if high school students can learn the material as well as college students. This study examined high-school and college students' learning by exposing them to the same text, a similar lesson plan, and the same test questions, while controlling for demographic, attitudinal, and experiential variables. Two questions were addressed: (a) Was there a practical difference between high school and college students in their ability to learn the material; and (b) was there a difference in the way they learned the material? The difference between college and high-school student learning as it was reflected by their test scores was less than three percentage points, with college students

averaging higher. Although this was a statistically significant difference, there appeared to be no practical difference between high school and college students in their ability to learn the material. However, simple mean comparisons indicated that besides age, grade level, and scores, college and high-school students differed in a statistically significant way in their perception of teacher involvement, and how easy the class was. Furthermore, hierarchically regressing scores on 0-order correlates, with a dichotomous variable representing high-school or college status entered last, still yielded a statistically significant difference between high-school and college student scores. Learning differences between groups were further defined using separate regression equations based on the expected independence of college students compared with the dependence of high school students. The expectation that there may have been a difference in the way students learned in high school and college appeared to have been confirmed. That is, factors related to independence seemed to predict college student scores better than those of high school students, and factors related to dependence predicted high-school student scores better than those of college students. (65 pages)

CHAPTER I

INTRODUCTION

Problem Statement

Education, and especially higher education, is believed to be the doorway to many opportunities. College-bound students have traditionally completed high school before being admitted to college, but simultaneous or concurrent high school and college enrollment appears to be growing (Greenburg, 1991; Sirotnik & Goodlad, 1988). Concurrent enrollment can provide three direct benefits to participating high school students. First, those who finish required high school classes early have an opportunity to take additional classes and obtain college credit for them. Second, high school students can be introduced to college-level material in a familiar (high school) environment. Third, the experience of taking college classes in high school might increase the students' potential for college attendance. However, little is known about the advisability of high school students enrolling in college-level courses. This lack of information about high school students taking college courses was the research problem addressed in the present study.

High school and university students were concurrently enrolled in a university-level class, exposed to similar classroom material, and then their learning was compared. The main study question was: Did high school students do as well as university students? More specifically, the study question was divided into two areas of interest: (a) Was there a practical difference between high school and college students in their ability to learn the material presented in Family and Human Development (FHD) 150: Human Growth and Development; and (b) are there dissimilarities in attitude and/or environment that lead to differences in learning? Underlying these questions was the concern: Was this a positive experience for the high school students?

Previous research in the area of high school and college concurrent enrollment is inconclusive (Egan, 1989; Delaney, 1988). Learning is a complex process that is influenced by many factors such as ability, attitude, and environment. A deeper understanding of differences between high-school and college student performance was obtained by collecting data that were assumed to represent aspects of these factors and by relating them to the learning process.

Rationale

The central question addressed by this study was: Could high school students learn the course material of FHD 150 (Human Growth and Development) with the same

effectiveness as university students? The dependent variable in this research was the student test scores on identical FHD 150 exam questions administered both in the high school and college classes.

Demographic or background variables that affect learning in high school and college undoubtedly have effects that make clear comparisons between them difficult (as evidenced by the inconclusive results in two previous studies [Egan, 1989; Delaney, 1988]). Therefore, the effects of key background variables on the dependent variable were controlled. The background variables that were considered in this study include: age, sex, GPA, college plans, parental encouragement, mother's and father's level of education, and in a very limited way, other aspects of the environment (see definition of environment, below).

Because the study was conducted with only two high schools and one university in northern Utah, the results are somewhat limited in their generalizability. Nonetheless, this study shed further light on some of the similarities and differences in learning between high school and college students participating in concurrent enrollment.

Definitions

Family and Human Development 150 -- described as "an overview of development from conception through maturity" (Utah State University Undergraduate Catalog, 1990-1992).

At USU this course counted toward general education credit in the social science quadrant, and it was made available for high school students.

High School Students -- defined as limited to 10th, 11th, and 12th grade students at two northern Utah High Schools, Sky View and Mountain Crest, in the Cache County School District.

College Students -- defined as limited to undergraduates at Utah State University who enrolled in designated sections of FHD 150, Human Growth and Development.

Learning -- defined by the level of success in correctly answering 210 selected questions dispersed among other questions on regularly administered exams in the FHD 150 course as taught in the high schools and at USU.

College Plans -- self-reported statement of a high school student concerning his or her intention to attend college.

Environment -- measured (in this study) as an attitudinal domain in which the student's learning was affected. It included the student's self-reported expectation of what would affect personal performance most: The teacher, personal problems, the self, and combinations of these three (see question #6 in demographic data sheet, Appendix A & B). It also included perceptions about how easy the class was and how well the teacher taught.

Conceptual Framework

There was no single conceptual framework guiding this study, but there were two related conceptual themes that intuitively guided it. The first was the possibility of a cognitive developmental difference between the abilities of persons in the general population of later high school students (ages 16-18) when contrasted with the general population of undergraduate university students (ages 18-22) (Maier, 1978). If there were cognitive, developmental differences, high school students and college students with similar GPAs might have been statistically different in terms of their scores on the course exams.

The second theme was an implication of systems and ecological theory in explaining why high school and college students might perform differently. Many social systems, including family, peer group, community, and the academic environment (consisting of school teachers and administrators), provide stimuli which likely affect student learning (Wilson, 1981; Collins & Mangieri, 1992).

Academic environments differ between high school and college (Clark, 1988). In a college setting, students have generally chosen to attend, are often living away from home, and may be facing stringent financial and GPA obligations to pursue their education. The extended university social system in which they move is geared toward encouraging and sustaining them in their efforts (Wilson, 1981). In

contrast, high school students might feel coddled or coerced to learn, and their peer group may in some cases discourage them from being serious about education (Chavira & Williamson, 1992).

Although it could have some implications for Family Life Education (FLE), this study is not intended to research that perspective. Family Life Education is primarily concerned with broadening an understanding of: Self and others; adjustment to sexuality; marriage and the family; and skills essential to healthy, effective, family living (Arcus, Schvaneveldt, & Moss, 1993). Although FHD 150 (an FLE-style class) is being used as a research tool, the study itself is merely a comparison between the learning of college and concurrently enrolled high school students. Do high school students do as well as college students taking the same course?

CHAPTER II

LITERATURE REVIEW

Cathy Collins and John N. Mangieri (1992) expressed concern that "the teaching of thinking per se is not part of the preparation process for either elementary or secondary teachers....school curricula do not significantly address the topic" (p. xi). There are implications in discussions of learning (i.e., Collins & Mangieri, 1992; Flower et al., 1990) that freedom of learning is often not encouraged in the public schools due to many factors which have existed for hundreds of years, and which result in the need to control, rather than to encourage free learning.

In his analysis of student learning in higher education, John Wilson (1981) noted that "there [were] interesting differences in the amount of 'freedom to learn' preferred by students in different faculties" (p. 42). Students often enter higher education "idealistic and keen to learn" (p. 48), but are forced into a frustrating hidden curriculum that reduces their motivation and personal interest (Wilson, 1981).

Nonetheless, there is an underlying implication that allowing students freedom to think when they reach higher education levels is important, both to increase effective learning and in practical applications of learning. Consequently, at that level, students are more often

encouraged to think and learn independently, especially in certain disciplines, such as the arts (Wilson, 1981).

This potential difference between high-school and college student thinking may be important in comparing their learning, yet there is little research literature comparing concurrent high school and college coursework, especially when that comparison includes an analysis of differences between these two groups on factors related to their learning. Concurrent enrollment literature is instead directed at four general themes: minority access to higher education (Forrest, 1989); promotional (Wolf & Geiger, 1986); advantages for gifted adolescents (Greenburg, 1991); and administrator-attitude investigative (Wilber, Lambert, & Young, 1987).

There is some interesting literature about study habits, self-esteem, and acculturation of minority groups in high school and the effect of these variables on the success of those who go on to college. Acculturation was found to have positive and negative effects on college success depending on factors related to race and peer-group expectations (Chavira & Williamson, 1992). Evidence suggests that the environment within the subculture of the black poverty community in high school has a powerful influence on students who might otherwise do well in school to "be cool," to skip school and to do poorly (Chavira & Williamson, 1992).

There may be similar acculturation problems in high school affecting learning among certain peer groups. It is likely, however, that the students choosing to take a high school class that offers college credit will not consist of students who are as susceptible to pressure to do poorly in school (Pechersky, Cervantes, & Matt 1991). If this study were based on a random, general sample of high school students, the anti-education high-school peer group might be more relevant to consider.

On average, the students who participated in this study had parents who had graduated from high school and obtained some college education. They live in an academic community and the majority of them hope to attend college (or are attending college), and likewise, the majority of their parents had high hopes that they would attend college.

There has been some interest in the effect on these students of concurrent enrollment in the agricultural departments at Utah State University. Three master's theses (Egan, 1989; Delaney, 1988; & Parkinson, 1989) and one doctoral dissertation (Hirpa, 1993) have been written on this topic. Although all three masters' theses expressed interest in attracting high school students into pursuing careers in agriculture, two of them, Egan (1989) and Delaney (1988), seemed more appropriate than the third (Parkinson, 1989) for comparison purposes with this current study.

These two studies compared the learning of high school students with college students in lower-level, undergraduate agricultural classes, considering variables of high school class level, GPA, and exposure to agricultural principles. Both studies attempted to create a classroom environment in which the course material was similarly presented. The exams were the same. In the Egan (1989) study, the final was administered by the local county extension agent but afterwards graded by the professor. In the Delaney (1988) study, the final exam was developed by an independent group of teachers using lesson objectives and a bank of 600 questions. Neither the high school teachers nor college professor saw the final exam until after it was administered.

Both groups used existing high school "Ag" teachers (having taught at the school 3 years or more) to teach the class (both studies included inservice training to attempt to maximize similarity in instruction). Despite attempts to standardize the experience, structural differences between high-school and college learning environments will probably result in interpretive difficulties with any concurrent enrollment study.

Unexplained extraneous variables may have caused the oddly divergent results of the two studies. Egan (1989) found no statistically significant differences between high school grade level and ability to learn the material

(although his numbers of high school freshman [2] and sophomores [7] were limited). Delaney (1988), however, found statistically significant differences between juniors' and seniors' test scores. Egan (1989) found the high school students less capable of learning the course material than college students despite the fact that the high school students had a higher mean GPA. Delaney (1988) found that high school students as a group were able to learn the material as well as the college students, despite the difficulty the high school juniors had with the course material. The mean GPA of the high school students was lower than the mean GPA of the college students, but the high school students scored slightly better than the college students on course exams (although the difference was not statistically significant).

Both authors expressed concern about differences in the instructional methods, although it seemed to be more of a factor in the Egan study, since there was a significantly higher average score in one of the high school classes compared to the others. That class had a particularly enthusiastic, enjoyable instructor.

Both Delaney (1988) and Egan (1989) were concerned with the high school students' ability to achieve passing grades in a college class. Delaney (1988) concluded that high school students could perform as well as college students; however, Egan (1989) merely asserted the concurrent

enrollment class would be a favorable recruitment tool for advanced placement (AP) agricultural students. (The high school students did less well compared to the college students in the Egan [1989] study.)

This study was similarly concerned with comparing the learning of high school and college students. Maier (1978) recognized that cognitive differences may be partially a result of Piagetian, static, cognitive-developmental stage achievement, but may also be flexible responses to Eriksonian social factors.

This study had a specific interest both in cognitive and social-environmental differences that might be present between high school and college students. Therefore, the effects of several variables in addition to those studied by Egan (1989) and Delaney (1988) were analyzed.

This effort helped shed light on the complexity of learning and the many difficulties encountered attempting to present data that were relevant to answering the main research question, namely, "can high school students learn college-level material as readily as undergraduate university students?" Because of the limited literature, and the lack of agreement between the two most relevant studies, the null hypothesis is stated.

Hypothesis

There will be no statistically significant difference between the learning of high school and college students as measured by in-class testing on the course material.

CHAPTER III

METHODS

Research Design

Classes at Sky View and Mountain Crest, and at Utah State University, were exposed to a similar process of instruction using the same college-level textbook. The specific questions from which the data for the study were obtained were dispersed among other test questions pertinent to the course. Students, but not teachers, were blind to which questions on a given test were used to compare high-school and college student performance.

Data from the university students were obtained from Fall Quarter 1992, and Winter and Spring Quarters 1993. The period of time during which instruction took place in the high school classes was 120 days compared to 55 days at the university classes (a scheduling difference at the high school which was beyond our control). One of the high school classes began in the fall and the other began in the winter.

Instructors were an FHD doctoral student in the USU class, a former FHD graduate student who is now a full-time high school teacher at Mountain Crest, and a full-time high school teacher at Sky View. Students in these classes were self-selected. No control group was possible in this research design; the design was a simple posttest only

comparison of student learning in existing high school and university classes as depicted in Figure 1 below. X_1, X_2, and X_3 represent the high school and college courses, each followed by a test (O) of student learning. This study was therefore a quasi-experimental comparison of learning between three self-selected groups of students studying the same text and being given ID-entered exams.

X_1 O

X_2 O

X_3 O

Figure 1. Study design.

Sample

The two high schools chosen to participate, Sky View (Smithfield, Utah) and Mountain Crest (Hyrum, Utah), were similar in size, with an approximate total enrollment of seniors in 1992-3, of 420 and 425, respectively. The college group was a regularly scheduled section of FHD 150 on campus at Utah State University (USU, Logan, Utah). The high-school and university students were voluntary participants. No attempt at random selection or assignment was feasible. The size of the participating groups from each of the three sources depended on the number of students who chose to take the class, and on the enrollment constraints peculiar to each location. Class sizes were 56

and 58 at Sky View and Mountain Crest, respectively, while the fall, winter, and spring classes of USU averaged 93.

Measurement

The dependent variable in this study was student test score. The same 210 questions were answered by students in each class, and scores were converted to percent correct. Except for age, school year, and test score, which were continuous variables, a five-point scale was used to measure the variables in the study. After the data were collected, they were recoded so that "1" indicated the smallest level on a variable and "5" indicated the highest. For example, on parents' education level, a "1" indicated that the parent did not complete high school and a "5" indicated completion of a graduate degree.

"College aspirations" indicated the participant's level of interest in attending college. "Parent's aspirations" indicated the parental level of interest in having the student attend college.

"Responsibility" investigated attitudes about responsibility for the student's learning. It ranged from forces outside the self (lowest) to the self alone (highest).

"Easy," "clarity," and "teacher's help" measured student perceptions of how easy the class was, how clearly it was taught, and how much help was received from the

teacher. "College interest" and "FHD interest" measured student level of interest as it was influenced by participation in the class. College interest was a variable only asked of high school students.

Data Collection Procedures

Instructors were fully aware of the intention of this study and the importance of following coordinated and standardized procedures in teaching the classes. All three teachers and the investigator met several times during the summer and twice more in the fall to structure lesson plans and select test questions together. Many more individual contacts were made by the investigator with each of the teachers as the study progressed.

Test questions were chosen from the Santrock (1992) A, B, and Berger (1988) test question banks. Each question was checked against the Santrock (1992) text (used in the class) to be sure the answer was apparent in the text. Any confusing or misleading questions were modified for the sake of clarity (i.e., "All but which of the following..." to "Which of the following...," etc.).

Two hundred ten universal questions (ten from each chapter) were selected by the concurrent enrollment study team. These questions were dispersed among other questions, as scheduled by the individual teacher according to her class plan. Thus, the teachers were not blind to the study

questions, although the students did not know which questions were being used to make the high school/college comparison. Assuming that the instructional methods were similar, the study questions provided data from which comparative analyses between the classes and the extraneous variables mentioned previously could be conducted.

Non-test-score variables were reduced to coded data using the results of a take-home questionnaire given at the first of each class (see Appendix A and B), and from a course evaluation administered at the conclusion of the class. These data examined student perceptions about their ability, attitude, and environment. They were used to help assess the uniformity, and explore the differences between high school and college.

Analysis Plan for the Data

The analysis plan was to first compare student test scores for the high-school and university concurrent enrollment groups in a simple way. After this initial comparison of raw mean scores, the non-test-score variables were examined to see which ones had a statistical relationship to students taking FHD 150 in high school or at the university.

The likelihood that students would take FHD 150 at the high-school and university level due to age, other background, and demographic variables was explored. The

effect of such variables on student learning needed to be considered to reduce the threat of selectivity bias. For example, to determine if there was a cognitive difference between the high-school and university students, these variables were entered as covariates in the analyses to isolate the influence of having FHD 150 at the high-school or college level on the student test scores.

The background and demographic variables on which high-school and university students were significantly different needed to be identified and controlled to reveal the net effect on learning. This was done by entering the relevant control variable first in hierarchical regression, and then examining the remaining (net) effect of high-school versus college grade level. If controls were not used, variance in student test scores might be incorrectly attributed to high-school and college grade level when test scores were related instead to other differences (such as GPA) between the groups.

Ethical Considerations

There were no particular ethical issues of concern for the participants in this study. The students were made aware of their participation. The subject matter was not generally considered controversial. Nothing about the design suggested emotional or physical risk to the subjects. Internal Review Board (IRB) approval at USU was explored,

but a formal review was not considered necessary. It was suggested that the high school students' names be removed from the data and an ID number be used instead, and this was done.

CHAPTER IV

RESULTS

This study examined the learning of high-school and university students who were concurrently enrolled in a college-level class, exposed to similar material, and then tested. The main question of interest was whether high school students could learn the material and perform as well as college students. More specifically, the practical difference between high-school and college students in their ability to learn the material presented in FHD 150, and whether there were dissimilarities in attitude and/or environment that led to differences in learning were analyzed. Underlying this interest was the concern: Was this a positive experience for the high school students?

Implicitly, three other questions were asked:

1. Would the high school students be encouraged by this experience to go on to college?

2. Would this experience influence them to pursue further classes in Family and Human Development?

3. What effect do various personal and demographic variables have on student learning, and do they differ between high school and college?

These questions were examined statistically at three levels:

1. First, simple descriptive statistics showing group sizes and raw mean comparisons were presented.

2. Next, the results of *t* tests were examined.

3. Finally, regression analyses concerning the effects of combinations of variables on learning were explored. In these analyses, test scores were regressed on key variables in various models. After ascertaining the effect of those variables in their separate groups on the dependent variable, class (high school vs. college grade level) was entered with all the other variables in a final model to see its effect with all of them controlled.

Descriptive Statistics

There were 395 students from whom data was collected for the study, 114 from high school, and 281 from college. There were approximately 4 females for every male who participated in the study (see Table 1). To explain the small but unavoidable differences in group size due to missing values, they were included in tables where *n* is listed.

Table 1

Gender Distribution by School

	HIGH SCHOOL		COLLEGE		TOTAL	
	n	%	n	%	N	%
MEN	19	(17)	53	(19)	72	(18)
WOMEN	94	(82)	227	(81)	321	(81)
MISSING	1	(1)	1	(0)	2	(1)
TOTAL	114	(100)	281	(100)	395	(100)

In Table 2, various demographic, experiential, and attitudinal variable means are presented as a simple comparison between the high-school and college students on the study variables. Raw test scores averaged almost 3 points higher for the college students. The high school students' average age was just less than 17, compared to the college students' average age of 20.5. Similarly, high school students were at about grade 12, whereas college students were near grade 14.

Except for college students who considered the class easy, and high school students who reported more teacher's help, the differences between these groups on the Likert-type variables were small, suggesting that the high-school and college students were similar in demographics and classroom experience. However, the differences on "easy" and "teacher's help" between high school and college were

statistically significant. That is, college students viewed the course as easier and teachers as having given them less help.

Table 2

Mean Comparisons on High-School and College Variables

VARIABLES	H.S.	COLLEGE	t	p
SCORE	78.9	81.7	-2.86	.004
AGE	16.9	20.5	-17.94	.000
SCH YR	11.9	13.9	-28.95	.000
FA'S ED	3.6	3.7	-.98	.325
MO'S ED	3.2	3.2	-.60	.548
COL ASP	4.6	4.7	.52	.606
PRNT ASP	4.1	3.9	1.42	.157
RESP	3.9	3.9	-.21	.835
EASY	3.0	3.2	-2.74	.007
CLARITY	4.2	4.0	1.60	.111
TCHR HELP	4.4	3.7	7.96	.000
COL INT	3.6	N/A		
FHD INT	3.5	3.3	1.38	.168

Because the two high schools were found to differ in significant ways, it was decided to simply designate them as HS1 and HS2. Since differences among groups are an important element in this study, an examination of mean differences on the study variables between Sky View (HS1)

and Mountain Crest (HS2) is given at the conclusion of this chapter.

In Table 3, the raw-mean scores of the five classes are compared (high school trimesters and USU quarters are indicated in parentheses). For comparison, the mean age is also listed. Although the mean scores of the three USU classes rose with each successive quarter (note the similar age increases), the high school classes followed a reverse trend; HS2, which held its FHD class the first two trimesters, had a higher mean score (and a lower mean age) than HS1 (the last two trimesters). This temporal comparison was confounded, however, by the fact that the high school teachers were different, whereas the same teacher taught the course all year at USU.

Table 3

Mean Score and Mean Age of All Testing Groups

CLASS	SCORE	AGE	n	MISSING
HS1 (2,3)	77.59	17.11	56	2
HS2 (1,2)	80.59	16.69	44	12
USU (Fall)	80.22	20.12	77	18
USU (Winter)	81.91	20.32	88	10
USU (Spring)	82.96	21.06	81	7

T tests

Table 4 presents statistical comparisons between score means of various class pairs. First, all high school participants and all college participants were compared. Next, various combinations between the five classes were tested, including comparisons of various combinations between fall, winter, and spring classes of USU. Finally, high school students and college freshmen were compared.

The most statistically significant result impacted directly on the study question. College students scored nearly 3 points higher than high school students, and the probability of drawing two samples with means this different from a group this size, was only 4 in one thousand.

The two other greatest differences in mean scores occurred between the two high schools ($p = .08$), and Fall and Spring Quarters of USU ($p < .04$). The actual percentage difference between the high schools was greater than that between the USU Fall and Spring Quarter classes, yet did not achieve statistical significance. Assuming that adding students would not change the mean-score difference between the high schools, more cases would have made the difference between the high schools statistically significant as well.

Table 4

T tests of Mean-score Differences Between all Groups

GROUPS	MEANS	n	MISSING	t	p
High Sch.	78.91	100	14		
College	81.73	246	35	-2.86	.004
HS1	77.59	56	2		
HS2	80.59	44	12	-1.77	.080
USU Fall	80.22	77	18		
USU W.S.	82.41	169	17	-1.96	.052
USU Winter	81.91	88	10		
USU F.S.	81.63	158	25	.26	.796
USU Spring	82.96	81	7		
USU F.W.	81.12	165	28	1.66	.098
USU Fall	80.22	77	18		
USU Spring	82.96	81	7	-2.08	.039
High Sch.	79.19	99	15		
USU Fresh.	80.47	108	15	-1.09	.278

Also of interest were the least statistically significant differences. When USU Fall and Spring Quarters were compared with Winter ($p > .79$), the almost linear increase in scores at USU from Fall to Spring Quarter was canceled. Similarly, combinations of Fall and Winter Quarters compared to Spring ($p < .06$), or Winter and Spring compared to Fall ($p < .1$), approached statistical significance and mirrored the linear relationship between Winter and Spring. The other least significant difference was obtained when the combined high schools were compared with USU freshmen ($p > .27$). The effect of similar age and grade level reduced the difference between high school and college (1.3 point difference).

In Table 5, the first test was a global test of the scores between male and female students. The next three tests examined the effect of gender and increasing age on score.

Compared to men's scores, women's scores increased much more substantially with age in the college sample. Additionally, it is helpful to understand that among college students, the relationship between test scores and age was greater (.099) than among high school students (-.002). There was also a statistically significant, negative relationship between age and sex in the college group (-.273), compared to a smaller, nonstatistically significant, positive relationship between age and sex in

the high school group (.049). Thus the relationship between age, gender, and test scores in the college group was complex.

Table 5

T tests of Mean-score Differences on Gender and Increasing Age

GENDER	MEANS	n	MISSING	t	p
Male	80.75	67	5		
Female	80.95	278	44	-.17	.861
(over 20)					
Male	81.74	38	4		
Female	84.51	47	7	-1.84	.069
(over 21)					
Male	81.71	34	3		
Female	85.15	33	4	-1.94	.056
(over 22)					
Male	81.35	20	3		
Female	85.29	24	4	-2.03	.048

Hierarchical Regression

To obtain a more complete understanding of the difference between the learning of high-school and college students, their scores were regressed on other variables of interest. Prior to the regression analyses, the 0-order correlations with score were considered. The grouping variable, dichotomized to represent high school and college (CLASS), level of education (SCHYR), GPA, AGE, father's education (FAED), college aspirations (CASP), feeling of personal responsibility (RESP), perception of the easiness of the class (EASY), and CLARITY with which the material was presented, all correlated at a level greater than or equal to .05 (two-tailed).

The threat of multicollinearity was considered. The 0-order correlation between SCHYR and CLASS was .64 and between SCHYR and AGE was .66. The correlation between these two variables was too high to enter them both into the same equation. AGE and CLASS correlated at a level of .47. Since AGE was highly correlated with SCHYR and less highly correlated with the dependent variable, AGE was chosen over SCHYR as a better choice for the equation.

Consistent with the means shown in Table 2, high-school and college students differed statistically on teacher's help (THELP), so it seemed important to place that variable in the equation. However, the 0-order correlation between SCORE and THELP was -.013, and even when the effect of other

variables was controlled, it still explained very little of the variance in test score, so THELP was not used.

Mother's level of education (MOED) was found to explain more variance than FAED in the equation, so FAED was dropped. Because of its complex relationship with college and high-school test scores, gender was included. Correlations between the variables chosen for analysis are found in Table 6.

Table 6

Pearson Correlations of Variables in the Analysis

	1	2	3	4	5	6	7	8	9
1. SCORE									
2. CLASS	.20**								
3. SEX	.01	-.02							
4. AGE	.15**	.47**	-.21**						
5. RESP	.16**	.01	-.06	-.04					
6. EASY	.16*	.12	-.01	.03	.04				
7. CLARITY	.19**	-.09	.09	-.02	.03	-.05			
8. GPA	.46**	-.23**	.08	-.22**	.08	.00	.11		
9. MOED	.08	.02	-.09	-.13*	.09	.09	.01	.11	
10. CASP	.13*	-.01	-.01	-.30**	.09	.16	.01	.19**	.16**

* $p > .05$ ** $p > .01$

Scores were hierarchically regressed on these variables in five models. Class was entered twice (Model 4 and Model 5) to ascertain what effect it had alone and in the equation after the other variables had been controlled, on the dependent variable (see Table 7).

In Model 1, score was regressed on SEX and AGE. SEX explained very little in this model. AGE was a much better predictor of score ($p \leq .01$), as might be inferred from the tables presented earlier. Older college students did better than younger ones in this study, although in high school alone, possibly due to differences in the schools, younger students did better than older students (HS2 students, who were younger, scored higher than HS1 students [see Table 3]).

In Model 2, over one fifth of the variance in score was explained. GPA was the dominant predictor ($p \leq .001$), with MOED and CASP contributing little, in the presence of GPA.

In Model 3, there was a greater balance between the predictors. All three contributed (.085 difference in beta between the least and the greatest), but only EASY and CLARITY achieved statistical significance ($p \leq .05, .01$).

In Model 4, when CLASS was entered alone, it achieved statistical significance ($p \leq .01$), although it only explained 2% of the variance in score. But in the final model, with the other variables controlled, it became even more statistically significant ($p \leq .001$). GPA retained its significance when the other variables were controlled and gained some predictive power (the unstandardized regression coefficient, b, increased by nearly 2 in Model 5 over Model 2).

Table 7

Standardized Regression Coefficients

of Hierarchical Regression

VARIABLE	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
1. SEX	.053				.034
2. AGE	.157**				.137
3. MOED		.050			.011
4. CASP		.036			.027
5. GPA		.454***			.580***
6. RESP			.123		.125*
7. EASY			.164*		.153**
8. CLARITY			.208**		.062
9. CLASS				.153**	.380***
R^2	.025	.221	.085	.023	.494
Adj R^2	.019	.213	.072	.020	.467

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

The final model explained nearly half the variance in score (R^2 = .494). However, two variables lost their statistical significance when the others were controlled (AGE and CLARITY), and another became statistically significant (RESP). SEX, MOED, and CASP remained less dominant contributors when the other variables were controlled.

Regression with Separate Equations

In a closer examination of the difference between high-school and college students, regression was used to examine unique ways that each group learned. In this analysis, there were two important considerations: (a) If GPA explained a great deal of the variance in variables which were important predictors of learning, it would be wise to drop it from the model because it was likely to reduce and distort important effects in a regression model which was designed to examine specific differences within high-school and college groups rather than predict score; and (b) if environment encouraged independence in college student learning and dependence in high-school student learning (see chapters I & II), two different regression models might be developed to predict test scores (and aid in understanding the different learning needs) of these groups. Following are explanations of intuitively appropriate variables for those models, first in high school, and then in college.

High School Students

Our competitive society requires children to continue their education until they graduate from high school. Additionally, classes are often large and traditional teaching methods emphasize control rather than freedom, possibly due to societal needs that are now outmoded (Tinzmann, Jones, & Pierce, 1992). There may, therefore, be

an environment of constraint in high schools, at least in the minds of students. If that feeling of constraint reduces the motivation to learn independently, dependency on parents and teachers to assist the learning process would be increased.

In that case, it would seem that effective teacher involvement (THELP) and the perceived easiness of the class (EASY) would be correlated with student test scores. Similarly, if it is true that parental involvement is important in this constraint-environment, a correlation with parents's level of education (in this case, FAED worked best) would seem likely. The predictive model for high school (see H.S., Table 8), therefore, included: THELP, EASY, and FAED.

College Students

Just as the high school equation used predictors which should intuitively work in an atmosphere of constraint, the equation which best predicts scores of college students should include variables which fit well with the proposed atmosphere of greater independence (RESP, CASP). Also, assuming the factors that influenced learning in high school become less salient with age and educational advancement, a combination of age and level of education (AGE + SCHYR = YEAR) should be considered. Despite a potentially weak effect, gender might be included to explain variance between male and female scores as age advances (as shown in Table

5). For these reasons, the variables included in the model predicting college students' grades were: RESP, CASP (the level of choice felt in choosing college), YEAR, and SEX (see COLLEGE, Table 8).

Mutual Exclusion

If high-school and college student learning is most accurately predicted by different regression equations, then each of those equations should only produce a statistically significant result when applied to the proper group. If the improper equation is used to predict college scores, a noticeable reduction in predictive power should result. That is, the standard error should rise and the R^2 should fall.

Therefore, model H.S.C. in Table 8 showed the effect of attempting to predict college student scores from the high school equation. Conversely, COLLEGEH showed the effect of attempting to predict high school student scores from the college equation.

Table 8

Separate Predictive Models on high school and College Student Scores

VARIABLE	H.S.	COLLEGE	H.S.C.	COLLEGEH
1. FAED	.138		-.019	
2. THELP	.137		.069	
3. EASY	.229*		.082	
4. CASP		.174**		.149
5. SEX		.072		.066
6. RESP		.173**		-.015
7. YEAR		.199**		.074
R^2	.097	.081	.008	.030
Adj. R^2	.066	.066	-.017	-.011

* $p < .05$ ** $p < .01$

Model H.S. explained about 10% of the variance in scores of high school students. Variable EASY was the most powerful predictor in the equation ($p < .03$). Model COLLEGE was more balanced, and YEAR, CASP, and RESP all predicted test scores of college students in a statistically significant way. Eight percent of the variance of test scores was explained, and the adjusted R^2 was identical to model H.S., and 6.6% of the variance in test scores was explained. In model H.S.C., when the high school model was

applied to college students, the equation lost its predictive power, and explained less than 1% of the variance in test scores. In model COLLEGEH, when the college model was used to predict high school student scores, only 3% of the variance was explained. The most powerful predictor of scores in model COLLEGEH was CASP but it did not achieve statistical significance in the equation. The adjusted $\underline{R}^2$ of both COLLEGEH and H.S.C. was negative, so in a statistical sense, both the high-school and the college model were able to explain variance only in the test scores of the group of students for which they were designed.

These models suggested that there were environmental differences between the high-school and college groups in this sample. These two groups differed less than 3 percentage points on test scores, and as shown in Table 4, the high schools differed by 3 points. Thus, there may have been environmental differences between the high schools as well. Mean differences on study variables between HS1 and HS2 are presented in Table 9.

Table 9

Mean Differences on Study Variables Between High School and College

VARIABLE	HS1	HS2	t	p
SCORE	77.6	80.6	-1.77	.080
AGE	17.1	16.7	4.23	.000
SCHYEAR	11.9	11.8	1.92	.058
FA'S ED.	3.7	3.5	1.12	.264
MO'S ED	3.3	3.0	1.45	.151
CO. ASP.	4.8	4.7	1.63	.107
PR. ASP.	4.1	4.2	-.48	.635
RESP.	3.9	4.0	-.61	.541
EASY	3.1	2.8	2.38	.019
CLARITY	4.3	4.0	1.82	.071
TE. HELP	4.5	4.3	1.55	.124
CO. INT.	3.5	3.8	-1.69	.095
FHD INT.	3.5	3.4	.59	.555

There was a statistically significant difference between age of students, and how easy they thought the class was. Approaching statistical significance was year of school, score, how clear the class material seemed, college aspirations, and interest in attending college, which was derived from the experience in the class.

CHAPTER V

SUMMARY AND CONCLUSIONS

Meier (1978) described the cognitive development of adolescents as the result of a combination of social and genetic factors that are not clearly defined nor agreed upon by theorists. There is no apparent absolute age when a transition occurs which makes more abstract thought possible (Flower et al., 1990), but it seems to be encouraged by various aspects of the learning environment which may differ between high school and college. Therefore, the "readiness" of a high school student to attend college is not a simple matter of age, but a result of a complex process which is dependent on many factors which arise both from within the student and from the environment in which he learns.

In answer to the question whether high school students could learn the material and perform as well as college students on the exams, there was a difference between the global mean scores of high-school and college students which was statistically significant. Since high school students also believed they had more help from the teacher, and had twice as long to study the material, it would seem that high school students did not learn the material and perform quite as well as college students on the exams.

However, the high-school and college score difference was not substantively different, given the variance in the subsets of scores. In fact, the mean-score difference

between the two high schools was 3 points, the difference between the combined high-school and college classes was 2.8 points, and was 2.7 points between the Fall Quarter and Spring Quarter at USU. A statistically significant difference may not be a practical difference under these circumstances.

There may be other important differences between all the groups analyzed. For example, apparent differences between the two high schools confound a simple combination in a comparison with the college students (see Table 9). In a comparison of the two high schools on the means of variables listed in Table 2, there were interesting differences, some of which are not intuitive. For example, although HS1 students had a lower mean test score than students at HS2, the mean-level of education of both mother and father was higher at HS1. Again oddly, in comparison to the self-report of HS2 students, HS1 students believed their class was easier and more clearly taught, which implies that they should have obtained higher scores, but they did not.

An explanation may be that HS1 students were almost exclusively seniors and their class was held in the final two trimesters of the year. Several reported that their scores may have suffered from "senioritis," which according to the student reports, is a mind-numbing malady brought on by the smell of freedom after 12 years of captivity.

HS2 students were more anxious about their understanding of the material, felt they got less help from the teacher, and thought the class was more difficult. Possibly as a result, they felt more responsible for their success, obtained better scores, and their desire to attend college was improved. Those factors might have caused them to feel a greater sense of independence than those at HS1, and independence seemed to be positively correlated with test scores.

The differences in age were probably because HS1 was taught later in the year than HS2. Age was recorded at the commencement of the study, and so HS1 had more students who had turned 18 than HS2. However, other less statistically significant differences implied the existence of substantive differences between the two high schools that may have confounded a clear comparison between high-school and college students.

Regarding test score differences between high school and college, it was concluded that there was not a practical difference between high-school and college students in their ability to learn the material presented in FHD 150. That is, high school students scored less than 3 percentage points lower than the college students. That was not enough of a difference to be concerned that they could not learn the material in a comparable way.

However, in response to the question "were there dissimilarities in attitude and/or environment that led to differences in learning," it appears there were. Although these dissimilarities did not stop high school students from *learning* the material adequately, the hierarchical regression analysis gave support to the idea that there was an important difference in the *way* high-school and college students learned as determined by success on the dependent variable. Even when several important variables were controlled, class was highly significant as a predictor of test scores. This occurred across other models not presented here, where class remained a consistent, statistically significant predictor of test score performance.

If there was an important difference between high school and college, it lay in the dissimilarities of their social environments. (See explanation of the results of regression with separate equations below.) Despite these differences, there was a preponderance of positive comments from the high school students on an open-ended question asking about their experiences inside and outside the class. Although it was generally those who did well who were complimentary about the class, at least one student who scored in the lower third of her group mentioned that it was very educational for her and had been a positive experience.

There were few negative comments. It would appear that it was a generally positive experience.

A good experience should affect the desire to go to college positively. The question about whether the student's desire to go to college was affected by participation in the class was directly asked in the high school course evaluation. The evaluation took place at the end of the class (see Appendix C), and among other questions, asked the student the effect the class had had on her/his likelihood to attend college. A score of "1" indicated that the student was much less likely to attend college as a result of the class, a "3" was an indicator of no change, and a "5" indicated the class had influenced the student strongly to attend college. Overall, the high school students had a mean score of 3.6 on this question, which implied that the experience in the class had had a favorable effect on the likelihood that students would attend college.

There was a similar response to the question about whether students were more or less likely to seek a major in FHD as a result of the class. As with college interest, in the course evaluation, "1" indicated that the class had influenced the student to be much less likely to pursue a major in FHD, a "3" indicated no change, and a "5" indicated a much greater chance of majoring in FHD. The combined high school classes responded with a mean of 3.5, which suggested

that the class had had a more encouraging than discouraging effect on students to choose to major in FHD in college. This was a larger effect than that among college students taking the class (3.3 in Table 2), so there is an implication that high school students are more easily influenced to major in FHD than are college students.

The fact that high school students are affected by the class in ways that encourage them to attend college and major in FHD is interesting in a practical way for the university and the FHD department. These results imply that the concurrent enrollment program is good for three reasons:

1. It provides an enjoyable, academically profitable experience for students.

2. It is an experience that helps the students choose to attend college.

3. It influences the students to major in FHD.

These results highlighted the more understandable differences between high-school and college students (i.e., their greater dependence and openness to change), but other dissimilarities prompt the question "were there important disparities between the environments in which these high-school and college students worked, that affected their learning?" The two regression equations developed in an attempt to match the expectation of what those differences might have been, applied separately to high-school and college students, gave more evidence that there were

important environmental differences. Each equation predicted better in the group for which it was designed. The high school equation, based on the idea that the student needed outside direction, and the college equation, which assumed an atmosphere of greater personal responsibility, were not interchangeable in predicting test scores.

More research is needed to explore whether there are meaningful differences between high-school and college environments, and to see if the results obtained in this study were due to the unique population of Cache Valley and Utah State University. If high school students generally have a different environment influencing their learning, their needs may be different. It would be helpful to understand those needs, as the concept of concurrent enrollment becomes more widely applied, so that students are able to obtain the greatest benefit from this opportunity.

Other Explanations for the Findings

Each quarter, the scores rose in the FHD classes on campus. As the school year progressed at USU, there may well have been a "weeding-out" process which was a result of less capable students dropping out of school, yet that weeding out process did not fully explain the relationship between age and score. Other important factors not discerned here may have contributed to this trend.

The teacher at HS2 had completed a graduate degree from the FHD department. That may have contributed to higher scores in an FHD class taught by her than could be expected from an instructor less familiar with the coursework.

"Senioritis," teacher, demographic, and attitude differences may also have contributed to the differences in scores between the high schools. HS2 fared better than HS1 when scores were predicted by the regression model intended for college students. The reason for that is not clear. Competition between teachers, the rivalry between HS1 and HS2, and positive or negative self-expectation among students might have contributed to that difference, confounding a clear comparison between the high schools.

Limitations

The primary limitation of this study as a direct comparison of learning between high-school and college students was that it was not taught by the same instructor, in the same location, under the same conditions, to all participants.

Second, the classroom experience lasted roughly twice as long in the high schools. The instructors were also dissimilar in some ways, as mentioned earlier. While these differences limit the conclusions that can be drawn from this study, they also represent the real-world differences of high-school and college course structure.

A third limitation was that the study was not double-blind. The teachers knew which subset of questions were going to be used in the study.

Finally, these were self-selected convenience samples. Students chose to take the class and no attempt at randomization was feasible. The study design was inadequate for making clear comparisons, and therefore the conclusions that can be drawn are less certain.

Summary

There is a need for research into differences in learning, if any, between high-school and college students, as opportunities in concurrent enrollment expand. This study was conducted in an attempt to more clearly understand if there were such differences in learning between groups concurrently enrolled in "Family and Human Development 150: Human Growth and Development," during the school year which began the fall of 1992.

It was impractical to scientifically control all of the key variables that would make it easier to understand differences in learning between groups in the high-school and college environments. Nonetheless, this study attempted to establish similarities in teaching methods through interactive meetings, where the teachers met and discussed lesson plans. The same text was used, and questions were carefully chosen that would accurately reflect the students'

knowledge of the material. Although the teachers were not blind to the questions, the students were.

Questions were chosen for an initial demographic survey and a final evaluation form to obtain demographic, environmental, and attitudinal information from the participants. By comparing this information first in a simple way, and then through regression analysis, it was hoped differences and similarities could be ascertained between high-school and college student groups.

There were differences between high-school and college students on the test scores they achieved. Despite receiving twice the instruction time, high school students scored slightly lower than college students. The difference was statistically significant and it persisted even when several variables were controlled. Factors relating to independence seemed to predict scores better in college, while high school scores were predicted better by how easy the class seemed and how much help was received from the teacher.

There were curious differences that were difficult to explain, and which prompt further investigation. For example, between the two high schools, parental level of education and the perceived easiness of the class favored one school, yet students in the other school scored higher.

Of course, group differences are part of the real world, and those found in this study may lie within

boundaries that do not preclude eventual understanding. Further research is necessary to understand if there are real differences between high-school and college learning environments and students, and if it is wise to attempt to reduce those differences. Based on the data analyzed in this study, however, there do not appear to be major difficulties with concurrent enrollment; high school students are able to learn the material in Human Growth and Development essentially as well as college students.

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APPENDIX

APPENDIX A
high school Demographic Data Sheet

Date_____ Identification Number_____

Age_____ School_____

Instructor_____

Year in School_____ Cumulative GPA_____

Please circle the most accurate answer.

1. Are you:
 a) Female
 b) Male

2. What was your father's level of education?

 a) didn't finish high school
 b) received high school diploma
 c) attended college, didn't finish
 d) graduated from college
 e) received advanced degree (master's, Phd, M.D. etc.)
 f) don't know

3. What was your mother's level of education?

 a) didn't finish high school
 b) received high school diploma
 c) attended college, didn't finish
 d) graduated from college
 e) received advanced degree (master's, Phd, M.D. etc.)
 f) don't know

4. I plan to attend college.

 a) strongly agree
 b) agree
 c) don't know for sure
 d) disagree
 e) strongly disagree

5. My parent(s) want me to go to college.

 a) strongly disagree
 b) disagree
 c) don't have an opinion
 d) agree
 e) strongly agree

6. My learning in this class will be affected <u>most</u> by

 a) how my teacher teaches
 b) my own efforts
 c) my personal problems
 d) both a and b
 e) a, b, and c

APPENDIX B
College Demographic Data Sheet

Name_____ Date_____

Social Security Number_____ Age_____

School_____ Year in School_____

Address_____ Phone_____

Instructor_____ Cumulative GPA_____

Please circle the most accurate answer.

1. Are you:

a) Female
b) Male

2. What was your father's level of education?

a) didn't finish high school
b) received high school diploma
c) attended college, didn't finish
d) graduated from college
e) received advanced degree (master's, Phd, M.D. etc.)
f) don't know

3. What was your mother's level of education?

a) didn't finish high school
b) received high school diploma
c) attended college, didn't finish
d) graduated from college
e) received advanced degree (master's, Phd, M.D. etc.)
f) don't know

4. In high school I planned to attend college.

a) strongly agree
b) agree
c) don't know for sure
d) disagree
e) strongly disagree

5. My parent(s) wanted me to go to college.

a) strongly disagree
b) disagree
c) don't have an opinion
d) agree
e) strongly agree

6. My learning in this class will be affected <u>most</u> by

a) how my teacher teaches
b) my own efforts
c) my personal problems
d) both a and b
e) a, b, and c

APPENDIX C
FHD Concurrent Enrollment Course Evaluation Sheet

Date_____ Identification Number_____

Age_____ School_____

Instructor_____

Year in School_____ Cumulative GPA_____

Please circle the most accurate answer.

1. How easy was this class?

   a) very difficult
   b) difficult
   c) neither hard nor easy
   d) easy
   e) very easy
   Comments:

2. Was the material taught in class and available in the text well-represented by the exams?

   a) Very poorly
   b) poorly
   c) some matched, some didn't
   d) well-represented
   e) very well-represented
   Comments:

3. Did the instructor help stimulate your attention and interest?

   a) Extremely well
   b) very well
   c) neither helped nor hindered
   d) did a poor job
   e) did a very poor job
   Comments:

4. Because of my experience in this class, the likelihood I will attend college is:

   a) much more likely
   b) more likely
   c) about the same
   d) less likely
   e) much less likely
   Comments:

5. Because of my experience in this class the likelihood I will seek a major in Family and Human Development is:

   a) much more likely
   b) more likely
   c) about the same
   d) less likely
   e) much less likely
   Comments:

6. Please explain other experiences, distractions or problems both in and outside of class that may have affected your performance either postively or negatively.